

Grok Wings: Your AI Takes Flight

A DIY GPS drone that plans missions from plain English. 7-inch about \$605, S500 about \$1,045.



COPPER GATOR AERO

Grok Wings: Your AI Takes Flight

Tell it where to go in plain English. Grok plans the mission, the GPS flies it, and the camera tells you what it saw.

Concept render

Why you'll love it

Missions by voice

Say 'survey the back pasture' and Grok turns it into an ArduPilot waypoint mission.

Eyes in the sky

The camera streams frames to Grok, and it describes what's below.

10-second swaps

Slide in a fresh pack, click the latch, plug in, and fly again.

Safe by design

GPS return-to-home, failsafes and Remote ID are part of the build from day one.

Two airframes, one brain



Concept render: 7-inch GPS quad



Concept render: S500 450 mm

7-INCH GPS QUAD

~\$605

Light and fast. Pi Zero 2 W bridge, 6S quick-swap pack.

S500 450 MM

~\$1,045

Pi 5, gimbal camera, long-range telemetry, longer flights.

Staged Build: pay as you go

Buy it in phases, cheapest first. Each stage flies on its own. Your Raspberry Pi 4B and 10-inch touchscreen are the ground station from day one, so there is no laptop or tablet to buy. Prices are estimates as of 23 Oct 2026 (SpeedyBee F405 V4 stack \$75.99 and Matek M10Q \$42.99 verified).

STAGE 1

7-inch GPS flyer

\$454 Running total \$454

Unlocks: GPS position hold, return-to-home, geofence, and ArduPilot waypoint missions planned with Grok on the Pi 4 touchscreen.

- 7-inch carbon frame + 4x 2806.5 1300KV motors, \$125
- SpeedyBee F405 V4 60A stack (ArduPilot), \$76
- Matek M10Q-5883 GPS/compass, \$43
- RadioMaster Pocket ELRS radio + receiver, \$80
- Standard Remote ID module, \$40
- One 6S 1500-1800 mAh pack + quick-swap sled + TPU legs, \$55
- Props + misc wiring, \$35

Reuses: Pi 4B + touchscreen ground station; robot Stage 2 balance charger (add \$55 if you skip the robot)

STAGE 2

Grok eyes onboard

\$95 Running total \$549

Unlocks: The camera streams frames to Grok, which describes what is below. A second pack means back-to-back flights.

- Raspberry Pi Zero 2 W + microSD + 5V 3A BEC, \$35
- Pi Camera Module 3, \$25
- Second 6S pack, \$35

Reuses: Whole Stage 1 airframe

STAGE 3 (OPTIONAL)

S500 heavy-lift

\$375 Running total \$924

Unlocks: Steadier video, mapping, 15-20 minute flights, room for a gimbal.

- Holybro S500 V2 kit (frame, motors, ESCs, props), \$160
- 2x 4S 5000 mAh packs, \$100
- Rail tray + tall gear, \$35
- 2-axis servo gimbal, \$50
- Vibration mounts + misc, \$30

Reuses: SpeedyBee FC, GPS, Remote ID, ELRS radio + receiver, Pi Zero + camera, charger

ADD-ON: SIK TELEMETRY

+\$60

915 MHz long-range link to the Pi 4 ground station.

ADD-ON: PI 5 COMPANION

+\$135

Pi 5 4GB (\$110 list) + cooler + BEC for onboard vision on the S500.

Stage	Cost	Running total	Unlocks
1 7-inch GPS flyer	\$454	\$454	GPS hold, return-to-home, waypoint missions
2 Grok eyes	\$95	\$549	Grok sees and describes; back-to-back flights
3 S500 (optional)	\$375	\$924	Steady video, mapping, longer flights

Shared, not double-counted: the 7-inch airframe here is the same one the Grok Scout uses. Build one airframe and switch roles with a Li-ion pack and bi-blade props (about \$77 more) instead of buying a second drone. The ELRS radio, Remote ID module (one aircraft at a time), charger and Pi 4 ground station also carry over.

What you can do with it

Land and fence checks

Fly the fence line and get a spoken report of anything that looks wrong.

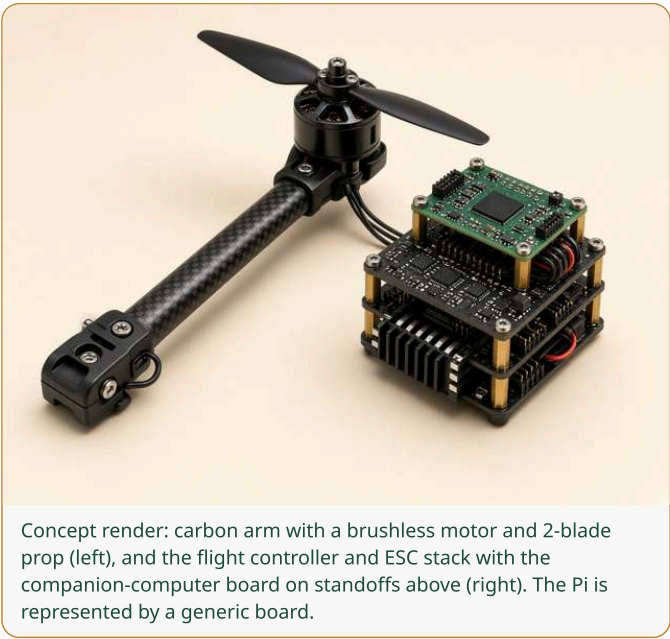
Mapping

Grid-survey photos for mapping and crop checks.

Search and spot

Ask it to look for the lost dog, the truck, or storm damage.

Up close: the parts



Concept render: carbon arm with a brushless motor and 2-blade prop (left), and the flight controller and ESC stack with the companion-computer board on standoffs above (right). The Pi is represented by a generic board.



Concept render: S500 underside, showing the battery in the printed quick-swap tray with latch tab and rubberized strap, the XT60 lead, the tall carbon landing gear, and the 2-axis gimbal camera (drawn under the pack here; in the build it sits forward of the pack)

What's the difference

	7-inch GPS quad ~\$605	S500 450 mm ~\$1,045
Frame	7-inch carbon X, about 300 mm motor-to-motor	S500, 480 mm wheelbase with tall gear
Motors / props	2806.5-2807 class, 1300 KV on 6S, 7-inch props	2216 class, 880-920 KV on 4S, 10-inch props
Payload	About 200-300 g: GPS, Pi Zero 2 W, small camera	About 500-800 g: Pi 5, gimbal camera, SiK telemetry
Flight time	About 8-15 min (6S LiPo); Li-ion can stretch it to 20+	About 15-20 min (4S 5000 mAh)
Better for	Fast scouting, wind, cheap crashes, portability	Steady video, mapping, heavier payloads, longer missions

Under the Hood: full specs, parts and build plan

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Concept render



Concept render, not a photo of the build.

Recommendation

Start with a 7-inch quad on ArduPilot; move to a 450 mm frame for payload.

A 7-inch carries a Pi Zero 2 W and GPS with 15-20 minutes of cruise flight and has good part availability. A 5-inch is too tight for a companion computer plus GPS. The 450 mm frame is slower and steadier, has room for a Pi 5 and a gimbal, and is easier to tune with ArduPilot defaults.

Use ArduPilot rather than INAV: it has proper MAVLink guided mode, missions, and geofence, which is what the Grok bridge needs. Prices verified 23 Oct 2026: SpeedyBee F405 V4 60A stack \$75.99 (55A discontinued), Matek M10-5883 \$42.99, Matek H743-WING V3 \$110, Pi 5 4GB \$110 list. Every other price is an estimate.

Parts list

Minimal (7-inch) Nicer (450 mm)

Category	Part	Price
Frame	7-inch carbon long-range frame (e.g. iFlight Chimera7 class)	\$45
Motors	4x 2806.5 1300KV (6S)	\$80
FC + ESC	SpeedyBee F405 V4 BLS 60A 30x30 stack (ArduPilot or INAV); US\$75.99 on speedybee.com	\$76
GPS/compass	Matek M10Q-5883 (Boulder MultiRotor lists the M10-5883 at \$42.99) or HGLRC M100	\$43
RC link	RadioMaster Pocket ELRS radio + RadioMaster RP2/BetaFPV ELRS receiver	\$80
Props	7in tri-blade props, 3 sets	\$10
Companion	Raspberry Pi Zero 2 W + Camera Module 3 + microSD + 5V 3A BEC	\$60
Remote ID	Standard Remote ID broadcast module (Holybro Remote ID or similar on the FAA declaration list)	\$40

Battery	2x 6S 1500-1800 mAh LiPo with XT60 (or 6S1P 21700 Li-ion for range), bottom-mounted for quick swaps	\$70
Quick-swap sled	Printed TPU/PETG battery sled on the bottom plate with a spring latch + a rubberized (non-slip) Kevlar strap as backup; XT60 pigtail fixed to the sled	\$12
Landing gear	Printed TPU legs, 45-55 mm, to clear the bottom pack	\$8
Charger	Smart balance charger, 100 W class (ISDT/ToolkitRC)	\$55
Misc	LiPo bag, XT60, silicone wire, straps, standoffs	\$25

3D-print in PETG or TPU: GPS mast, Pi Zero/Pi 5 mount, camera mount, antenna holders, Remote ID module holder, battery sled/tray.

Quick-swap battery

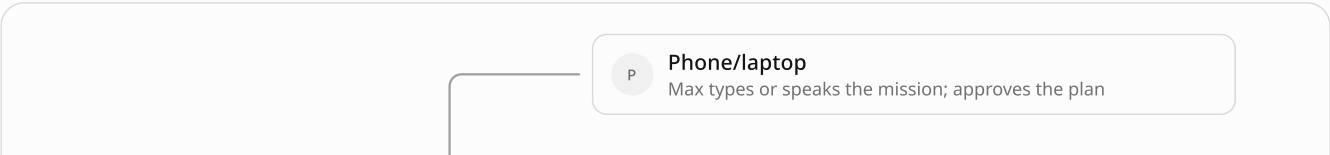
- Mount: the pack rides under the frame on a printed sled (7-inch) or slide-in rail tray (S500). A spring latch holds it, and a rubberized strap is the backup. The XT60 (or XT90 on the S500) pigtail is fixed to the sled so the plug lines up the same way every time.
- Under-10-second swap: unplug, pop the latch, slide the pack out, slide the new one in until it clicks, plug in. Mark the pack and tray so the pack always goes in at the same position.
- CG: center the pack under the FC on both X and Y. With a full pack installed, lift the drone by two fingertips on opposite arms; it should hang level. Move the pack stop forward or back until it does. Bottom-mounted packs are more stable in pitch and roll but slower to respond, which is fine for GPS missions.
- Prop clearance: the pack and straps must stay inside the motor circle, with at least 10 mm between any strap tail and the prop arc. Trim and tuck the strap tails.
- GPS clearance: run the high-current battery leads low and twisted, and keep the GPS/compass on its mast at least 10 cm above them. Run compassmot in ArduPilot after any battery-mount change.
- Landing gear: a bottom pack needs 40-50 mm under the pack on the 7-inch (TPU legs about 50 mm), and the S500 needs taller gear (150-200 mm) for the pack plus the gimbal moved to the front.

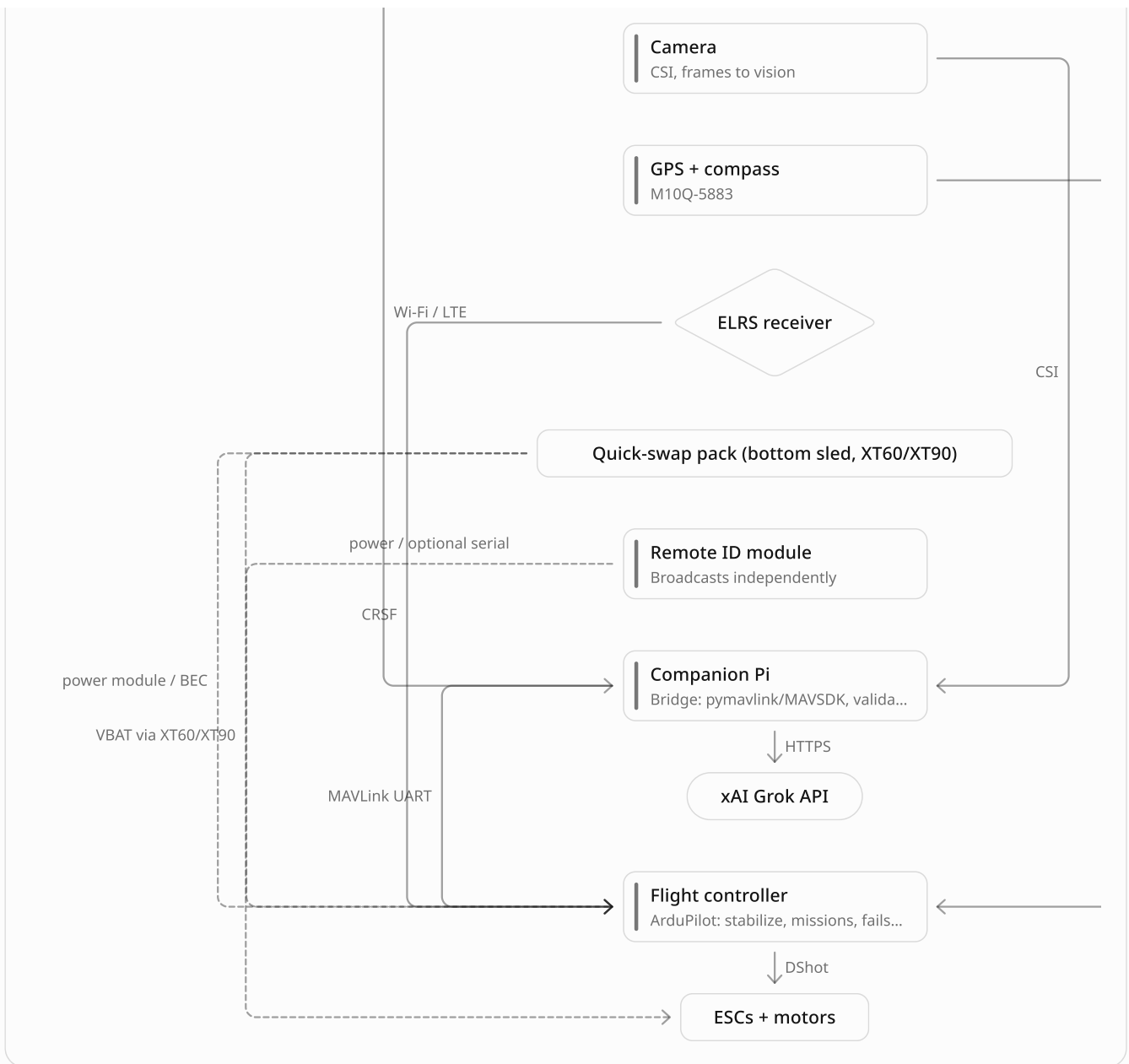
Cost totals

Build	Hardware	Notes
Minimal (7-inch)	\$540 to \$670 (about \$605)	Pi Zero 2 W sends camera frames to Grok; quick-swap bottom pack
Nicer (450 mm)	\$935 to \$1,185 (about \$1,045)	Pi 5, gimbal, SiK telemetry, quick-swap tray, tall gear

US import duty on direct-from-China orders (SpeedyBee states a prepaid 54%) can move these totals a lot; US resellers are often cheaper once landed. Add \$5 for the FAA registration.

Architecture





How Grok plans missions

Hard rule	The AI never has direct stick control. It only proposes high-level actions; ArduPilot flies, and the pilot on ELRS can take over at any time by switching modes.
Tools exposed	<code>plan_mission waypoints, alt_m, speed_ms</code> , <code>describe_view()</code> , <code>get_status()</code> , <code>return_to_launch()</code> , <code>land()</code>
Not exposed	Arming, raw RC override, disabling the fence or failsafes, changing parameters
Validator	The Pi checks every waypoint against the polygon fence, a 120 m (400 ft) AGL cap, distance from home, and battery reserve before anything is uploaded
Human approval	The plan is shown on a map; Max confirms, then arms and launches himself in a manual mode before switching to AUTO
Vision	<code>describe_view()</code> sends a JPEG plus GPS/altitude/heading to a vision-capable Grok model and returns a text summary; it never steers

1 Ask

"Survey the back pasture at 40 m and tell me if the fence line is down."

2 Plan

Grok calls `plan_mission` with lat/lon waypoints; the Pi validates them and writes them to the FC as a MAVLink mission.

3 Approve and fly

Max reviews and confirms; ArduPilot flies AUTO with the fence and failsafes active.

4 Describe

At each waypoint the Pi grabs a frame and Grok describes it; results are logged with coordinates.

FAA rules

Topic	What applies
Recreational	Fly under 49 USC 44809: pass the free TRUST test, carry the certificate, follow CBO safety guidelines, stay at or below 400 ft, keep it in visual line of sight
Part 107	Needed for any commercial or compensated use (paid survey, selling photos). Remote Pilot Certificate knowledge test, registration as Part 107, and LAANC for controlled airspace
250 g threshold	Under 250 g recreational needs no registration or Remote ID. Both builds here weigh far more, so register (\$5) and mark the registration number on the airframe
Remote ID	Required for registered drones: a broadcast module, or built-in Standard RID. A homebuilt can't get built-in compliance, so use an FAA-accepted broadcast module, or fly only at a FRIA
Airspace	Shreveport has Class C around SHV and Class D at Barksdale AFB and Downtown; get LAANC authorization through an app like Aloft before flying in those areas
Autonomy	Automated waypoint flight is legal, but the pilot must keep line of sight and be able to take control at once; BVLOS needs a waiver

Check faa.gov/uas before the first flight; rules and accepted Remote ID module lists change.

Build order

1. TRUST and registration

Pass TRUST, register at FAADroneZone, buy the Remote ID module.

2. Bench power

Solder XT60, capacitor, and ESC leads; smoke-stop for the first power-up; check the BEC voltage.

2b. Battery sled and gear

Print and fit the bottom sled or tray and the tall landing gear; fix the XT60/XT90 pigtail to the sled; check CG with a full pack and practice a swap until it takes under 10 seconds.

3. FC firmware

Flash ArduPilot (SpeedyBee F405 V4 or MatekH743 target), calibrate accelerometer and compass, set up the frame class.

4. RC and failsafe

Bind ELRS, set modes (Stabilize, AltHold, Loiter, RTL, Auto), test RC-loss failsafe with props off.

5. Motors

Check motor order and direction with props off; DShot ESC setup.

6. Hover and tune

Props on, outdoors, Stabilize hover, then AltHold and Loiter; run ArduPilot autotune.

8 7. Fence and failsafes

Polygon fence, altitude 120 m, battery failsafe to RTL, GCS-loss failsafe; verify each one in flight.

9 8. Companion link

Pi to FC over UART at 921600 MAVLink2; read telemetry with pymavlink, nothing that commands flight yet.

10 9. Grok planning on the ground

Run the planner in SITL (ArduPilot simulator) until the validator rejects every bad plan.

11 10. First AI mission

Short 3-waypoint mission, low altitude, open field, finger on the mode switch.

12 11. Camera descriptions

Add `describe_view()` at waypoints; log the images and descriptions.

Gotchas

LiPo safety

- Charge in a LiPo bag on concrete, never unattended, at 1C.
- Store at 3.8 V/cell; retire puffed packs.
- A hot Louisiana car trunk kills LiPos and can start fires.
- Battery failsafe: RTL at 3.5 V/cell under load, land at 3.3 V.

Interference

- Pi Wi-Fi/USB3 and video wires desense GPS; mount GPS high on a mast, shielded.
- Keep the compass away from battery and ESC leads; calibrate away from steel.
- Soft-mount the FC; vibration wrecks the EKF.

Thermal and power

- The Pi 5 needs 5 V at up to 5 A; a dedicated BEC, not the FC's 5 V pad.
- Pi Zero 2 W throttles in summer sun; add a heatsink.
- ESCs need airflow; don't wrap the stack in a sealed shell.

Weather and humidity

- Not waterproof: no rain or fog flights; Shreveport dew condenses on cold electronics.
- Conformal-coat the FC and ESC, keep silica gel in the case.
- Gusty afternoons: check winds; a 7-inch struggles above about 25 mph.

References



SpeedyBee F405 V4 stacks (prices)
speedybee.com



Matek GPS and flight controllers (prices)
bouldermultirotor.com



xAI API voice and realtime docs
docs.x.ai



FAA drone rules
faa.gov



